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Research Article

The diet of Barn Owl (*Tyto alba*) in Georgia

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Abstract

The Barn Owl (*Tyto alba*) has only recently colonized Georgia, yet has rapidly expanded throughout the country's lowland agricultural landscapes. Despite its increasing presence, no prior comprehensive study has examined its diet in Georgia. We analyzed 6627 prey items from Barn Owl pellets collected between 2023 and 2025 at 34 sites across five Georgian regions. After sterilization and dissection, prey remains were identified to the lowest possible taxonomic level and biomass was estimated. The results show that mammals dominate the diet, accounting for 98.6% of all prey items, with rodents (53% by number, 75% by biomass) and shrews (45% by number, 23% by biomass) being the most common prey groups. Other prey included birds, bats, amphibians, reptiles, and invertebrates. Notably, *Mus macedonicus*, *Microtus socialis*, and *Crocidura* spp. were the most frequent mammalian prey. Geographic variation in diet composition was observed, with some sites showing a predominance of shrews. This study provides novel insights into the Barn Owl's feeding ecology in Georgia and offers the first regional data on several small mammal species, including updated records for *Micromys minutus* and *Suncus etruscus*. Given the owl's preference for rodents, it may serve as a valuable component of sustainable rodent control strategies in Georgian agriculture.

Key words: Barn Owl, diet, pellets, prey, rodents, shrews, pest control

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Introduction

The Barn Owl (*Tyto alba*) has established itself in Georgia only in recent decades and, within approximately 25 years, has expanded across much of the country's lowland agricultural regions (Kitel et al. 2025). Its current distribution is closely tied to areas intensively utilized by local communities for farming (Belik 2024). Despite this recent and rapid spread, information on the Barn Owl in Georgia remains limited and fragmentary (Bukreev 2003; Galvez et al. 2005; Budagashvili and Javakhishvili 2024; Topaloudis et al. 2025). Although interest in the country's biodiversity has grown in recent years (Mumladze et al. 2019), Barn Owl remains among the least studied bird species in Georgia.

As a specialized nocturnal predator, the Barn Owl plays an important role in regulating populations of small mammals, especially rodents and shrews. Analyses of owl pellets have proven to be an effective method for investigating predator diets and offer valuable insights into local small mammal fauna

(Kryštufek et al. 2009; Riegert et al. 2011; Milana et al. 2018). In Georgia, dietary studies of raptors are rare and have so far focused only on diurnal species (Abuladze 2013). Moreover, recent comprehensive reviews of the country's small mammal fauna make no mention of data derived from owl pellet analysis (Bukhnikashvili et al. 2023; Kandaurov et al. 2023; Natradze et al. 2023), indicating a significant knowledge gap.

Globally, Barn Owls are increasingly recognized as effective agents of biological pest control, especially in agricultural ecosystems (Tores et al. 2005; Sebele et al. 2020; Bontzorlos et al. 2024). Although their diet is largely dominated by small mammals, they also opportunistically consume other taxa, including birds, bats, reptiles, amphibians, and invertebrates (Roulin and Dubey 2012, 2013; Vale-Gonçalves et al. 2015; Roulin 2016).

In Georgia's fertile lowlands, where agricultural activity is intense, the Barn Owl may represent a promising natural solution for controlling rodent pests. Based on this context, the present study hypothesizes that rodents constitute the primary component of the Barn Owl's diet in Georgia and that the species may play an ecologically and economically valuable role in supporting sustainable pest management practices.

Material and methods

Study area

Barn Owl pellets were collected across Georgia between 2023 and 2025 from 34 locations situated in five administrative regions: Adjara, Imereti, Kakheti, Kvemo Kartli, and Samegrelo-Zemo Svaneti (Fig. 1). Sampling sites were associated with known roosting and breeding areas of dispersing Barn Owls.

Fresh pellets were characterized by a glossy, lacquered surface with a blackish tint due to salivary coating, consistent with descriptions by Mikusek (2005) and Poprach (2010).

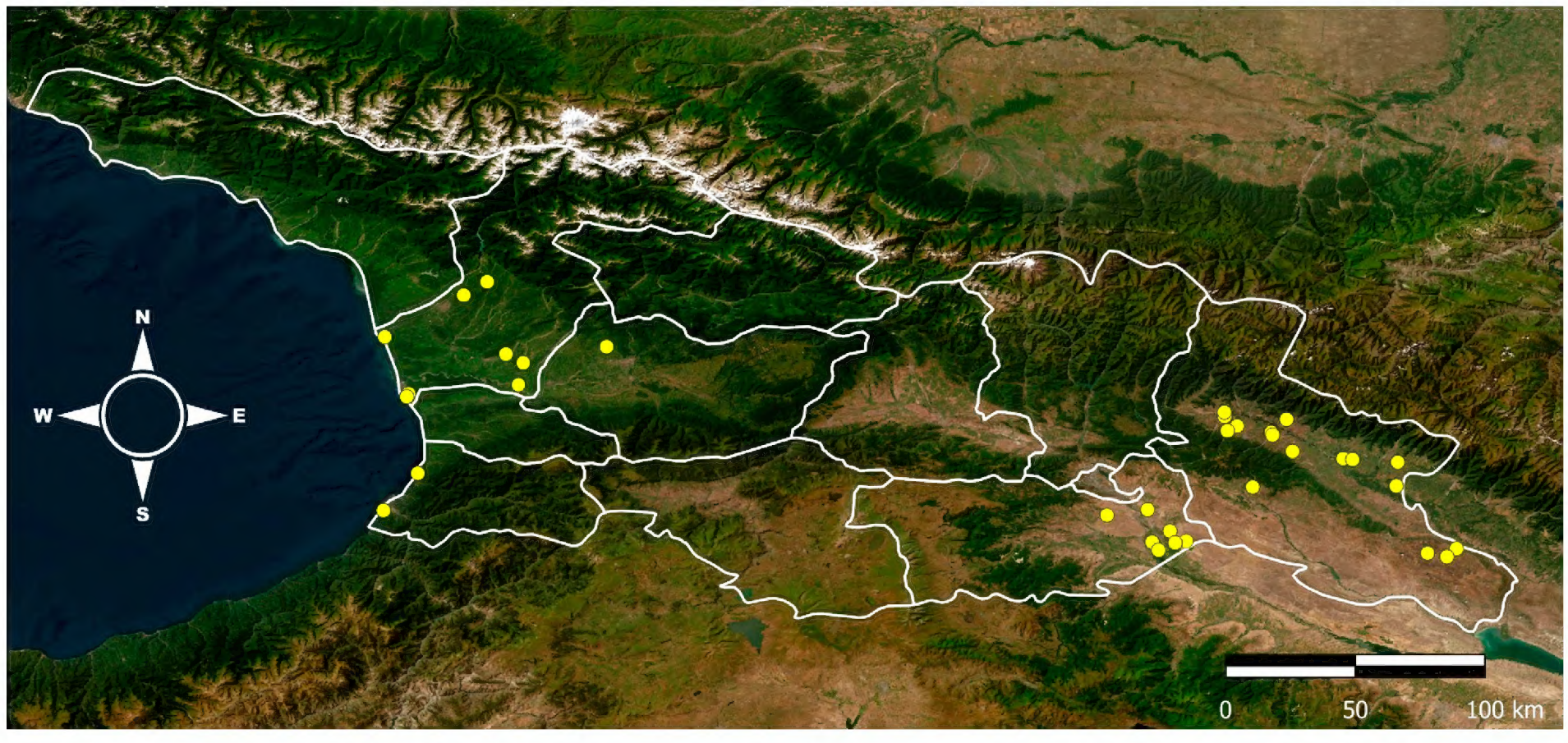

Figure 1. A map of Georgia with 34 sites where Barn Owl (*Tyto alba*) pellets have been collected in 2023–2025.

To ensure biosafety and facilitate dissection, all pellets were sterilized by oven-baking at 160°C for 40 minutes, following the protocol of Orosz-Coghlan et al. (2022), and then soaked in warm water. A total of 6627 prey items were extracted and identified to the lowest possible taxonomic level (Table 1).

Table 1. The number of preys from Barn Owl (*Tyto alba*) pellets by regions in Georgia.

Region	Number of sites	Number of preys
Adjara	2	302
Imereti	1	37
Kakheti	16	3804
Kvemo Kartli	7	1827
Samegrelo-Zemo Svaneti	8	657
Total	**34**	**6627**

Species identification

Prey remains extracted from Barn Owl pellets included mammals, birds, amphibians, reptiles, and invertebrates. Mammals (Rodentia, Eulipotyphla, Chiroptera, Carnivora) were identified using standard taxonomic keys and monographs (Pucek 1981; Kryštufek and Vohralík 2001, 2005, 2009; Aulagnier et al. 2009; Zaitsev et al. 2014; Tembotova 2015; Kryštufek and Shenbrot 2022, 2025; Russo 2023). Species nomenclature followed recent national checklists (Bukhnikashvili et al. 2023; Kandaurov et al. 2023), with the only exception being the use of *Crocidura gueldenstaedtii* instead of *Crocidura suaveolens*, as used in earlier and modern classifications (Bukhnikashvili 2004; Gazzard and Kryštufek 2024).

Due to local morphological variation in Caucasian rodents, standard identification methods were sometimes insufficient, and additional references were consulted. For example, distinguishing *Microtus socialis* required intact skulls and ratios of rostrum height and interorbital constriction to condylobasal length, along with proportionally large auditory bullae (Vinogradov and Gromov 1952; Kryštufek and Kefelioğlu 2001). Although *Microtus rossiaemeridionalis* has recently been recorded in Georgia (Maglakelidze et al. 2024), its morphological similarity to *M. obscurus* necessitated treating all specimens as *M. obscurus* in the absence of DNA data.

Cranial features were used to separate *Rattus rattus* and *R. norvegicus*, mainly based on molar shape (Pucek 1981; Yiğit et al. 1998; Kryštufek and Vohralík 2009).

Identification of Pine Voles (*Microtus majori*) relied on specific M1 patterns of the lower mandible, while *M. subterraneus* was excluded based on its known distributions; in addition, *M. daghestanicus* was excluded due to its preference for high-altitude habitats, whereas all our data were collected in lowland areas (Çolak et al. 1998; Kryštufek and Vohralík 2004; Aulagnier et al. 2009).

In many cases, *Mus* and *Apodemus* specimens were too fragmented for species-level identification. For *Mus*, separation of *M. musculus* and *M. macedonicus* used zygomatic index (Zagorodniuk 2002; Çolak et al. 2006; Kryštufek and Vohralík 2009), though this was not always conclusive due to damaged remains. Third molar ratios provided limited accuracy. *Apodemus* species were

identified to genus level unless diagnostic features (e.g., bullae or tooth row length) were intact, as overlapping morphotypes (e.g., *A. ponticus*, *A. witherbyi*) complicate identification (Darvish et al. 2014; Mohammadi et al. 2014; Okulova et al. 2018; Maglakelidze et al. 2024).

Bird remains were identified mainly from skulls (Brown et al. 2021; Drewitt 2024), using an osteological reference collection. Ulna shape was of limited diagnostic value (Panteleev 2005). As no published data exist on bird biomass in Georgia, we used mean body mass data from the Aras Bird Ringing Station in Türkiye, based on measurements of 2511 individuals collected in 2023–2024.

Amphibians and reptiles were not identified to species level; representative species (*Hyla orientalis*, *Lacerta agilis*) were used for biomass estimation (Shlyakhtin et al. 2019; Burraco et al. 2021). Invertebrate remains were identified by specialists (A. Seropian, A. Schröter, T. Stalling), and biomass was estimated using published mean weights, rounded to 1 g where necessary (Cornwell 1976; Meresman and Ribak 2020; Hendrix and Verdonschot 2021).

Results and discussion

A Diet composition in pellets

A total of 6627 prey items were extracted from Barn Owl pellets and identified to the lowest possible taxonomic level. Of these, 996 individuals originated from western regions (Adjara, Imereti, Samegrelo-Zemo Svaneti), and 5631 from eastern Georgia (Kakheti and Kvemo Kartli). By number and mass Rodentia prevail among other preys with 3528 individuals or 87726.7 g. The second largest group of mammals as preys is Eulipotiphla with 2985 individuals or 28037.9 g. The rest of animal groups estimate 114 individuals or 1749.1 g (Table 2).

Table 2. Total prey composition of Barn Owl (*Tyto alba*) pellets in Georgia by taxonomic group and biomass contribution.

Species	Numb. of Ind. West	Numb. of Ind. East	Total Numb. of Ind.	Mean Ind. Mass (g)	Total Biomass (g)
Sorex satunini	0	15	15	5.9	88.5
Sorex volnuchini	110	0	110	4.3	473
Sorex raddei/satunini	0	4	4	5.9	23.6
Neomys teres	11	0	11	18	198
Crocidura leucodon	11	206	217	12.8	2777.6
Crocidura gueldenstaedtii	22	270	292	9.3	2715.6
Crocidura sp.	318	1968	2286	9.3	21259.8
Suncus etruscus	0	41	41	1.9	77.9
Talpa levantis	6	0	6	47.1	282.6
Talpa sp.	3	0	3	47.1	141.3
Dryomys nitedula	2	3	5	24.1	120.5
Glis glis	0	2	2	89.6	179.2
Apodemus uralensis	4	0	4	20.2	80.8
Apodemus uralensis/witherbyi	9	4	13	20.2	262.6
Apodemus sp.	76	312	388	20.2	7837.6
Micromys minutus	85	4	89	9	801
Rattus norvegicus	31	1	32	259	8288

Species	Numb. of Ind. West	Numb. of Ind. East	Total Numb. of Ind.	Mean Ind. Mass (g)	Total Biomass (g)
Rattus rattus	5	0	5	188.4	942
Rattus sp.	17	1	18	188.4	3391.2
Mus musculus	44	32	76	22.7	1725.2
Mus macedonicus	0	513	513	16.1	8259.3
Mus sp.	36	1013	1049	16.1	16888.9
Mesocricetus brandti	0	1	1	108.7	108.7
Arvicola amphibius	1	4	5	170	850
Microtus majori	64	1	65	23.8	1547
Microtus obscurus	88	54	142	36.4	5168.8
Microtus socialis	0	454	454	27.9	12666.6
Microtus obscurus/socialis	0	667	667	27.9	18609.3
Mustela erminea	1	0	1	150	150
Myotis blythii	0	1	1	15	15
Myotis sp.	0	1	1	3.8	3.8
Pipistrellus sp.	10	6	16	3	48
Hirundo rustica	4	0	4	20.2	80.8
Hirundinidae sp.	13	1	14	20.2	282.8
Galerida cristata	0	1	1	38.2	38.2
Acrocephalus sp.	0	2	2	11.6	23.2
Turdus philomelos	1	0	1	70	70
Turdus sp.	1	0	1	70	70
Passer domesticus	0	4	4	26.9	107.6
Fringilla coelebs	3	7	10	21.5	215
Carduelis cannabina	0	2	2	17.8	35.6
Carduelis carduelis	0	2	2	16.3	32.6
Emberiza sp.	0	1	1	26.1	26.1
Passeriformes sp.	9	13	22	22.3	490.6
Anura sp.	4	1	5	5.4	27
Squamata sp.	0	1	1	6.9	6.9
Dytiscus sp.	1	0	1	1.9	1.9
Protaetia sp.	0	1	1	1	1
Scarabaeidae sp.	3	3	6	1	6
Blatta orientalis	1	1	2	1	2
Bolivaria brachyptera	0	1	1	1	1
Calliptamus barbarus	0	1	1	1	1
Decticus albifrons	0	2	2	1	2
Decticus sp.	0	3	3	1	3
Gryllus sp.	1	5	6	1	6
Gryllotalpa gryllotalpa	1	0	1	1	1
Xeropicta derbentina	0	1	1	1	1
Rodentia	462	3066	3528		87726.7
Eulipotyphla	481	2504	2985		28037.9
Carnivora, Mustelidae	1	0	1		150
Chiroptera	10	8	18		66.8
Aves	31	33	64		1472.5
Amphibia, Anura	4	1	5		27
Reptilia, Squamata	0	1	1		6.9
Invertebrata	7	18	25		25.9
Total	***996***	***5631***	***6627***		***117513.7***

Small mammals overwhelmingly dominated the diet: rodents accounted for 53% of all prey by number and 75% by total biomass, while shrews (Soricidae) comprised 45% by number and 23% by biomass. Together, these two groups made up 98% of total biomass (Fig. 2). Other vertebrates—bats, birds, amphibians, reptiles—and invertebrates were rare (Table 2).

Among 1099 unbroken pellets, length ranged from 21.6 to 81.0 mm (mean = 39.8 mm), and width from 14.6 to 45.9 mm (mean = 26.0 mm) (Fig. 3). Each pellet contained between 1 and 13 individual prey items (mean = 3.53) (Fig. 4). Only 6 pellets contained more than 10 prey items, with those dominated by small Soricidae. Altogether, 3883 prey items (58.6% of total) were recovered from intact pellets.

The pellet with the highest prey count (13 individuals) came from Poti (Samegrelo-Zemo Svaneti) and contained 11 *Sorex volnuchini*, 1 *Neomys teres*, and 1 *Crocidura* sp. Another highly diverse pellet from Shiraki (Kakheti) held 11 *Crocidura* sp.

Taxonomically, the Barn Owl diet in Georgia included representatives of five vertebrate classes and invertebrates (Fig. 5). Mammals dominated with 98.6% of prey by number, followed by birds (1.0%), and a combined 0.4% from amphibians, reptiles, and invertebrates.

Variation across sites

Although rodents dominated the overall diet of Barn Owls in Georgia, notable geographic variation was observed. At sites with over 200 prey items (n=10) —indicating long-term owl presence—shrews (Soricidae) occasionally outnumbered rodents by number or biomass (e.g. Nazarlo, Chailuri, Poti) (Table 3). This pattern may reflect temporary declines in rodent populations, potentially driven by population cycles or pesticide use in agricultural areas.

These local deviations align with previous observations that Barn Owls exhibit selective opportunism, primarily preying on rodents when available (Tores et al. 2005). In other countries, high consumption of shrews by Barn Owls has also been

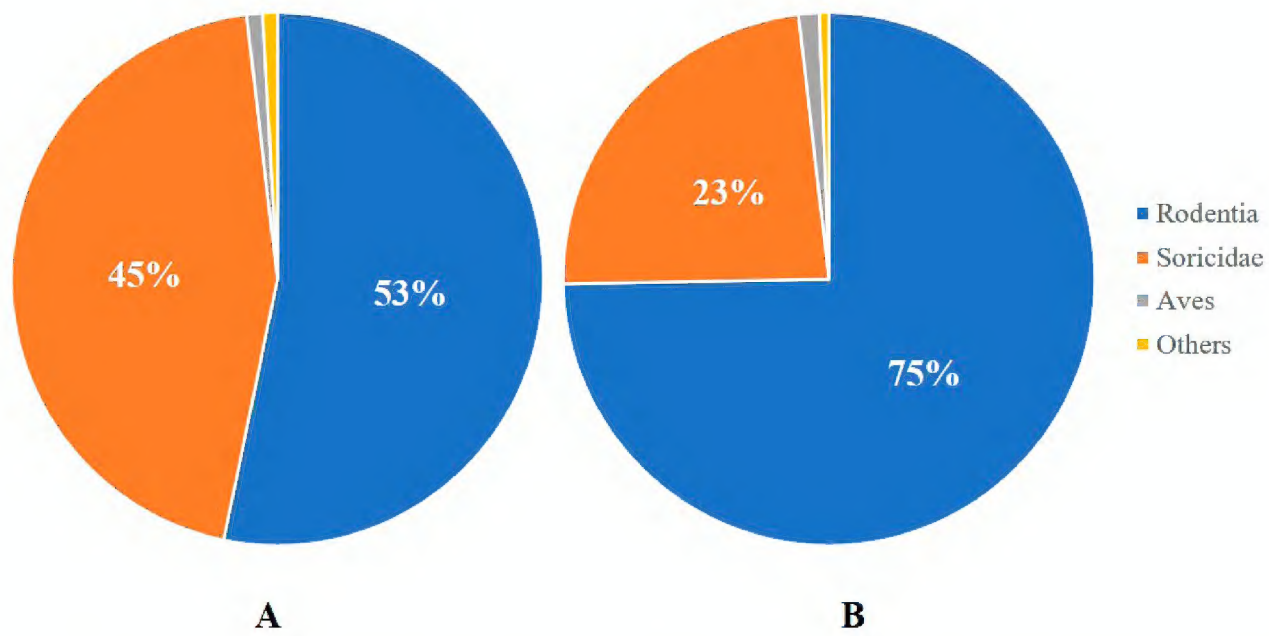

Figure 2. Prey composition in the diet of Barn Owl (*Tyto alba*) in Georgia by: **A**: number of individuals, **B**: biomass (%).

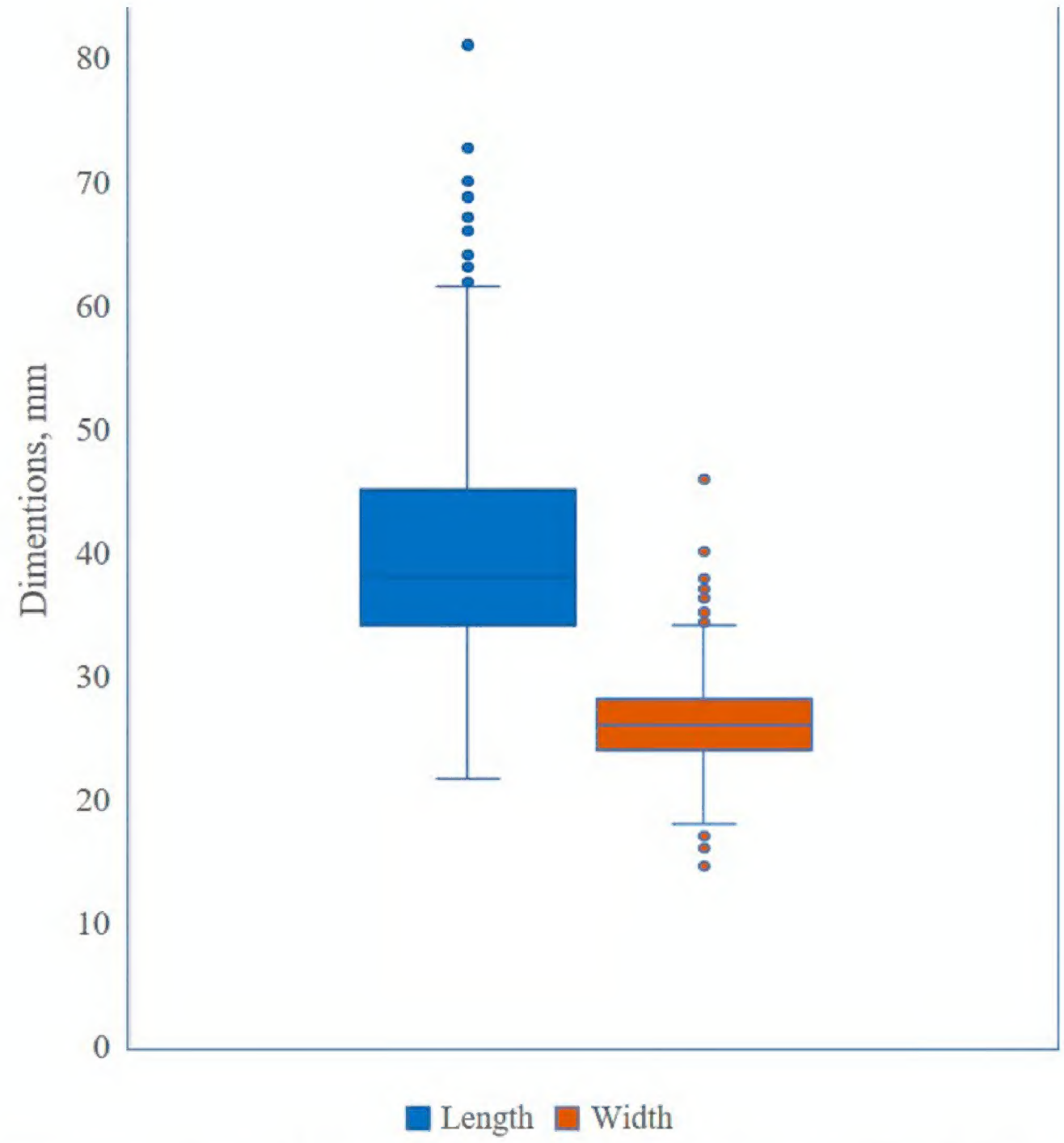

Figure 3. Distribution of Barn Owl (*Tyto alba*) pellet dimensions (n = 1099).

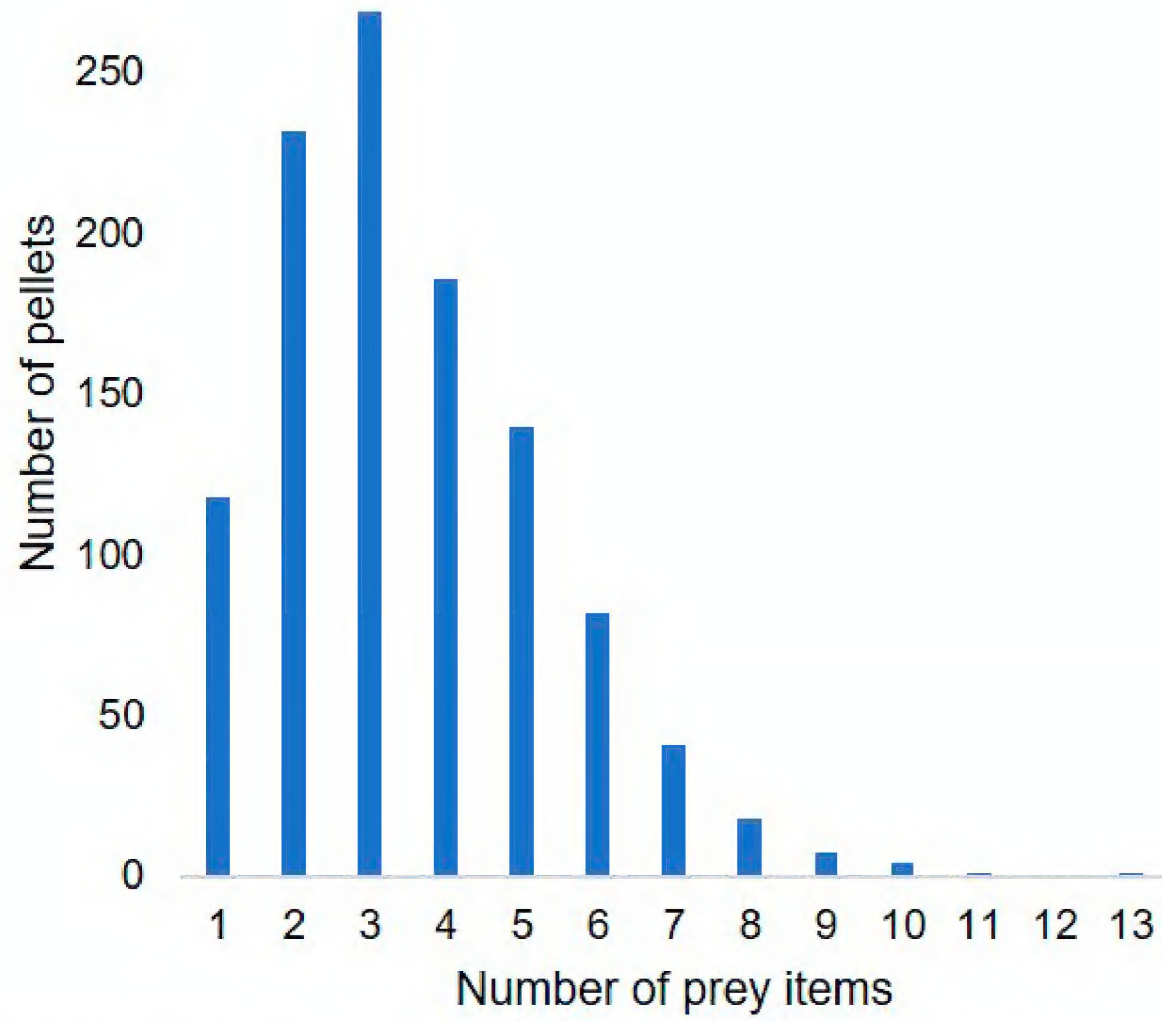

Figure 4. Number of prey items per unbroken Barn Owl (*Tyto alba*) pellet (n = 1099).

Figure 5. Selected prey remains from Barn Owl (*Tyto alba*) pellets: **A**: *Mus musculus*; **B**: *Decticus* sp. (Orthoptera); **C**: *Pipistrellus* sp. (Chiroptera); **D**: *Dryomys nitedula*; **E**: Rodentia: *Apodemus* sp.; **F**: *Crocidura gueldenstaedtii*; **G**: *Sorex volnuchini*; **H**: *Hirundo rustica*; **I**: *Micromys minutus*; **J**: *Talpa levanti*.

Table 3. The share of Rodents and Shrews in Barn Owl (*Tyto alba*) diet at different sites.

Site Name	Nr of preys	Rodents. %		Shrews. %	
		Nr	Biomass	Nr	Biomass
Koghoto, Kakheti	1586	68	82	31	17
Nazarlo, Kvemo Kartli	931	33	52	67	48
Gremi, Kakheti	866	70	84	30	16
Chailuri, Kakheti	424	22	38	77	62
Akhali Samgori, Kvemo Kartli	382	56	74	43	26
Avgia, Adjara	300	62	90	28	5
Poti, Samegrelo-Zemo Svaneti	286	22	51	69	39
Tkviri, Samegrelo-Zemo Svaneti	247	45	72	54	26
Kondoli, Kakheti	224	43	61	57	39
Kumisi, Kvemo Kartli	211	73	86	27	14

reported, including Germany (Gurney 1876), Italy (Bose and Guidali 2001), Greece (Bontzorlos et al. 2005), and Turkey (Hoppe 1986). However, due to the absence of similar pellet studies in the Caucasus region, it remains unclear whether the patterns observed here are typical for the region or unique to Georgia.

Certain species account

Owl pellet content is representative for real proportions of the small mammal species in their communities at the open areas (Andrare et al. 2015). Pellet analysis also provided new insights into the distribution of several small mammal species in Georgia.

Pygmy White-toothed Shrew (*Suncus etruscus*). Previously known only from eastern Georgia (Buknikashvili 2004), this species was detected exclusively in Kvemo Kartli and Kakheti. The presence of 41 individuals suggests a more common and widespread status than previously assumed, corroborating recent regional observations (Kandaurov et al. 2023). Similar records of *S. etruscus* in owl pellets have been reported from southeastern Turkey (Coşkun and Kaya 2013).

Harvest Mouse (*Micromys minutus*). Historically reported from only seven western Georgian sites, mainly from older records (Bukhnikashvili et al. 2023), *M. minutus* was recorded here from Adjara and, for the first time, from eastern regions (Kvemo Kartli, Kakheti), with 89 individuals identified. These findings significantly extend its known range.

Transcaucasian Water Shrew (Neomys teres) and Caucasian Pygmy Shrew (*Sorex volnuchini*). Despite being widely distributed in Georgia (Buknikashvili 2004), both species were found only in pellets from the Poti region. This site—formerly a marshland and now a canal system with rich vegetation and no agriculture—likely supports suitable habitats. Their absence elsewhere likely reflects a sampling bias toward agricultural landscapes, which are less favorable for these species.

Brandt's Hamster (*Mesocricetus brandti*). Only a single individual was recorded at Shiraki (Kakheti), a steppe habitat considered atypical for Barn Owl hunting. However, with the owl's ongoing range expansion into suboptimal habitats, occasional predation on large desert rodents may become more frequent.

Conclusion

This study represents the first comprehensive analysis of the Barn Owl's diet in Georgia, covering a wide geographic range and providing a dataset of over 6600 prey items identified from owl pellets. The overwhelming dominance of small mammals, particularly rodents and shrews, confirms that the Barn Owl functions primarily as a specialist predator on terrestrial micromammals, although its capacity to exploit other taxa—including birds, bats, amphibians, reptiles, and invertebrates—reflects opportunistic tendencies when primary prey availability fluctuates.

The high representation of rodents (53% by number and 75% by biomass) supports the hypothesis that Barn Owls may play a significant ecological role in regulating rodent populations in Georgia's agricultural landscapes. This aligns with findings from other regions where Barn Owls are already integrated into pest management strategies. At the same time, the significant presence of shrews in certain areas and years suggests sensitivity to local prey dynamics, possibly influenced by natural population cycles or anthropogenic factors such as pesticide use.

From a faunistic standpoint, the study contributes valuable records for small mammal distribution in Georgia, including the easternmost confirmations of *Suncus etruscus* and previously undocumented occurrences of *Micromys minutus* in eastern regions. These results underline the utility of owl pellet analysis as a complementary method for biodiversity assessments, especially in understudied or inaccessible habitats.

The research also identifies several methodological and interpretative challenges, including species-level identification difficulties due to cranial damage

or cryptic morphology, and the need for more detailed ecological data on the small mammal communities being preyed upon.

Going forward, a multi-seasonal and multi-year monitoring program, complemented by live-trapping and habitat assessments, would help clarify temporal prey fluctuations, reveal effects of agricultural practices, and further test the feasibility of using Barn Owls as a nature-based solution for rodent control. Such efforts could also enhance our understanding of the ecology of prey species, many of which remain poorly documented in Georgia.

Altogether. the Barn Owl emerges not only as a key predator with potential agricultural utility, but also as a valuable bioindicator and sampling tool for small mammal communities in the region. As Georgia continues to integrate biodiversity research into conservation and land-use planning, expanding the scope of such integrative studies is essential for promoting sustainable coexistence between wildlife and human activities.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

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Author contributions

DK collected and desiccated Barn Owl pellets, conceived an idea of the paper and wrote the manuscript; ZJ was responsible for the collaboration between Ilia State University (Georgia) and University of Bialystok (Poland) to implement the project.

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Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.

References

Abuladze A (2013) Birds of Prey of Georgia. Materials towards a Fauna of Georgia. Issue VI. Tbilisi, 218 pp.

Andrade A, de Menezes JFS, Monjeau A (2016) Are owl pellets good estimators of prey abundance? Journal of King Saud University – Science 28: 239–244. https://doi.org/10.1016/j.jksus.2015.10.007

Aulagnier S, Haffner P, Mitchell-Jones AJ, Moutou F, Zima J (2009) Mammals of Europe, North Africa and the Middle East. London, Bloomsbury Wildlife, 272 pp.

Belik VP (2024) Current expansion of the Barn Owl (*Tyto alba*) (Tytonidae, Aves) in Northern Eurasia. Biological Bulletin of the Russian Academy of Sciences 51: 3154–3168. https://doi.org/10.1134/S1062359024701930

Bontzorlos VA, Peris SJ, Vlachos CG, Bakaloudis DE (2005) The diet of Barn Owl in the agricultural landscapes of central Greece. Folia Zoologica 54(1–2): 99–110.

Bontzorlos V, Cain S, Leshem Y, Spiegel O, Motro Y, Bloch I, Cherkaoui SI, Aviel S, Apostolidou M, Christou A, et al. (2024) Barn Owls as a nature-based solution for pest control: A multinational initiative around the Mediterranean and other regions. Conservation 4: 627–656. https://doi.org/10.3390/conservation4040039

Bose M, Guidali F (2001) Seasonal and geographic differences in the diet of Barn Owl in an agro-ecosystem in northern Italy. Journal of Raptor Research 35(3): 240–246.

Brown R, Lees D, Ferguson J, Lawrence M (2021) Tracks and Signs of the Birds of Britain and Europe. 3rd ed. Bloomsbury Publishing, London, 416 pp.

Budagashvili N, Javakhishvili Z (2024) The birds of Georgia: an updated checklist using citizen science platforms. Sandgrouse 46: 2–29. [Accessed: 20 September 2025]

Bukhnikashvili A (2004) On cadastre of small mammals (Insectivora, Chiroptera, Lagomorpha, Rodentia) of Georgia. Tbilisi, 136 pp. [In Russian]

Bukhnikashvili A, Kandaurov A, Sheklashvili G, Natradze I (2023) All records of rodents (Mammalia, Rodentia) and hares (Mammalia, Lagomorpha) in Georgia from 1855 through to 2022. Biodiversity Data Journal 11: e108740. https://doi.org/10.3897/BDJ.11.e108740

Bukreev SA (2003) The data on the breeding of Barn Owl on the Caucasus. Strepet 2: 80–81. [In Russian]

Burraco P, Bonzom JM, Car C, et al. (2021) Lack of impact of radiation on blood physiology biomarkers of Chernobyl tree frogs. Frontiers in Zoology 18: 33. https://doi.org/10.1186/s12983-021-00416-x

Coşkun Y, Kaya A (2013) Additional records of *Suncus etruscus* (Savi, 1822) (Mammalia: Soricidae) from Southeastern Anatolia, Turkey. IUFS Journal of Biology 72(2): 31–35.

Cornwell PB (1976) *Blatta orientalis*. Animal Diversity Web. https://animaldiversity.org/accounts/Blatta_orientalis/

Çolak E, Sözen M, Özkurt Ş (1998) A study on taxonomic status of *Microtus subterraneus* and *Microtus majori* in Turkey. Turkish Journal of Zoology 22: 119–129.

Çolak E, Yiğit N, Sözen M, Çolak R, Özkurt Ş, Kankiliç T (2006) The morphological analysis of *Mus domesticus* and *Mus macedonicus* in Turkey. Turkish Journal of Zoology 30(3): 309–317.

Darvish J, Mohammadi Z, Ghorbani F, Mostafavi E (2014) Morphometric characterisation of the Eastern Broad-toothed Field Mouse *Apodemus mystacinus* from Zagros Mountains, Iran. Acta Zoologica Bulgarica 66(4): 461–468.

Drewitt E (2024) Bird Pellets: A Complete Photographic Guide. Finidr, Czech Republic, 258 pp. https://doi.org/10.53061/NUXA1756

Galvez RA, Gavashelishvili L, Javakhishvili Z (2005) Raptors and Owls of Georgia. GCCW & Buneba Print Publishing, Tbilisi, 128 pp.

Gazzard A, Kryštufek B (2024) *Crocidura gueldenstaedtii* (Europe assessment). The IUCN Red List of Threatened Species 2024: e.T29653A221736051. https://doi.org/10.2305/IUCN.UK.2024-2.RLTS.T29653A221736051.en [Accessed: 15 July 2025]

Gurney JH (1876) Barn Owl and Shrew. Zoologist 2nd Series 11: 4871.

Hendrix P, Verdonschot P (2021) Observations on the growth of *Dytiscus dimidiatus* larvae reared on single or multiple prey species. Entomologische Berichten 81(4): 153–159.

Hoppe N (1986) Pellet contents of the Barn Owl, *Tyto alba*, near Samandağ, Turkey. Zoology in the Middle East 1: 29–32. https://doi.org/10.1080/09397140.1986.11770907

Kandaurov A, Bukhnikashvili A, Sheklashvili G, Natradze I (2023) The occurrence of insectivores (Mammalia, Eulipotyphla) in Georgia from 1864 through to 2022. Biodiversity Data Journal 11: e106256. https://doi.org/10.3897/BDJ.11.e106256

Kitel D, Songulashvili Z, Javakhishvili Z (2025) Expansion of the Barn Owl *Tyto alba* in Georgia. Sandgrouse 47: 209–218. [Accessed: 20 September 2025]

Kryštufek B, Kefelioğlu H (2001) The Social Vole Microtus socialis in the Near East. Mammal Review 31(3): 229–237. https://doi.org/10.1111/j.1365-2907.2001.00088.x

Kryštufek B, Vohralík V (2001) Mammals of Turkey and Cyprus. Volume 1: Insectivora. University of Primorska, Koper, 140 pp.

Kryštufek B, Vohralík V (2004) Molar size variation in three species of pine voles in Asia Minor. Israel Journal of Zoology 50(4): 311–319. https://doi.org/10.1560/VX7E-YCPB-1L7R-GEJ1

Kryštufek B, Vohralík V (2005) Mammals of Turkey and Cyprus. Volume 2: Rodentia I: Sciuridae, Dipodidae, Gliridae, Arvicolinae. University of Primorska, Koper, 292 pp.

Kryštufek B, Vohralík V (2009) Mammals of Turkey and Cyprus. Volume 3: Rodentia II: Cricetinae, Muridae, Spalacidae, Calomyscidae, Capromyidae, Hystricidae, Castoridae. University of Primorska, Koper, 372 pp.

Kryštufek B, Vohralík V, Obuch J (2009) Endemism, vulnerability and conservation issues for small terrestrial mammals from the Balkans and Anatolia. Folia Zoologica 58(3): 291–302.

Kryštufek B, Shenbrot GI (2022) Voles and Lemmings (Arvicolinae) of the Palaearctic Region. University Press, Maribor. https://doi.org/10.18690/um.fnm.2.2022

Kryštufek B, Shenbrot GI (2025) True Hamsters (Cricetinae) of the Palaearctic Region. University Press, Maribor. https://doi.org/10.18690/um.fnm.1.2025

Maglakelidze S, Bukhnikashvili A, Sheklashvili G, Natradze I, Kandaurov A, Mumladze, L (2024) Exploring small mammal diversity in Georgia (Sakartvelo) through DNA barcoding. Biologia 79: 2789–2803. https://doi.org/10.1007/s11756-024-01742-1

Meresman Y, Ribak G (2020) Elastic wing deformations mitigate flapping asymmetry during manoeuvres in rose chafers (*Protaetia cuprea*). Journal of Experimental Biology 223(24): jeb225599. https://doi.org/10.1242/jeb.225599

Mikusek R (Ed.) (2005) Methods of investigation and conservation of owls. FWIE, Kraków. [In Polish]

Milana G, Luiselli L, Amori G (2018) Forty years of dietary studies on Barn Owl (*Tyto alba*) reveal long-term trends in diversity metrics of small mammal prey. Animal Biology 68(2): 129–146. https://doi.org/10.1163/15707563-17000095

Mohammadi Z, Darvish J, Ghorbani F, Mostafavi E (2014) First record of the Caucasus field mouse *Apodemus ponticus* from Iran. Biodiversity Journal 5(4): 475–480.

Mumladze L, Japoshvili B, Anderson EP (2019) Faunal biodiversity research in the Republic of Georgia: a short review of trends, gaps, and needs in the Caucasus biodiversity hotspot. Biologia 75(1): 1385-1397. https://doi.org/10.2478/s11756-019-00398-6

Natradze I, Bukhnikashvili A, Sheklashvili G, Mumladze L (2023) Bats of Georgia – an occurrence dataset from 1835 through 2022. Biodiversity Data Journal 11: e103181. https://doi.org/10.3897/BDJ.11.e103181

Okulova NM, Bogdanov AS, Baskevich MI, et al. (2018) [Skull sizes and proportions in west-Palearctic wood mice (*Sylvaemus*) from eastern Europe. 1. Interspecific variability]. Zoological Journal 94(11): 1418–1433. https://doi.org/10.1134/S0044513418110065 [In Russian]

Orosz-Coghlan P, Sullivan LM, Gerba CP, Schmidt RH (2022) The microbiology of Barn Owl pellets, with special reference to pellets used in educational settings. https://doi.org/10.13140/RG.2.2.15224.11523

Panteleev AV (2005) Identification of families of passerine birds by the distal part of the ulna. Russian Ornithological Journal 14 (express issue 304): 1033–1039. [In Russian]

Poprach K (2010) The Barn Owl. TYTO, Nenakonice, Czech Republic.

Pucek Z (1981) Keys to Vertebrates of Poland: Mammals. Warsaw: PWN – Polish Scientific Publishers.

Riegert J, Šindelář J, Zárybnická M, Horáček I (2011) Large-scale spatial patterns of small mammal communities in the Mediterranean region revealed by Barn Owl diet. Scientific Reports 11: 4985. https://doi.org/10.1038/s41598-021-84683-y

Roulin A (2016) Strong decline in the consumption of invertebrates by Barn Owls from 1860 to 2012 in Europe. Bird Study 63: 146–147. https://doi.org/10.1080/00063657.2015.1125440

Roulin A, Dubey S (2012) The occurrence of reptiles in Barn Owl diet in Europe. Bird Study 59: 504–508. https://doi.org/10.1080/00063657.2012.731035

Roulin A, Dubey S (2013) Amphibians in the diet of European Barn Owls. Bird Study 60: 264–269. https://doi.org/10.1080/00063657.2013.767307

Russo D (2023) Handbook of the Mammals of Europe: Chiroptera. Springer. 963 pp. https://doi.org/10.1007/978-3-030-44029-9

Sebele L, Mundy P, Fritz H, Guerbois C (2022) Perceptions on Barn Owls and their use in rodent control: a case study of Hwange District. Tropical Conservation Science 15: 1–12. https://doi.org/10.1177/19400829221120175

Shlyakhtin GV, Tabachishin VG, Yermokhin MV (2019) Seasonal diet variations of the Sand Lizard (*Lacerta agilis*) in the Northern Lower-Volga Region. Povolzhskiy Journal of Ecology 3: 396–401. https://doi.org/10.35885/1684-7318-2019-3-396-401 [In Russian]

Tembotova FA (2015) [Mammals of Caucasus and the Seas Washing it: A Guide]. Scientific Publishing Partnership KMK, Moscow. 352 pp. [In Russian]

Topaloudis A, Cumer T, Lavanchy E, Ducrest AL, Simon C, Machado AP, Paposhvili N, Roulin A, Goudet J (2025) The recombination landscape of the Barn Owl, from families to populations. Genetics 229(1): iyae190. https://doi.org/10.1093/genetics/iyae190

Tores M, Motro Y, Motro U, Yom-Tov Y (2005) The Barn Owl – a selective opportunist predator. Israel Journal of Zoology 51: 349–360. https://doi.org/10.1560/7862-9E5G-RQJJ-15BE

Vale-Gonçalves HM, Barros P, Braz L, Cabral JA (2015) The contribution of Barn Owl feeding ecology to confirm bat species occurrence in north Portugal. Barbastella 8(1): 22–26. https://doi.org/10.14709/BarbJ.8.1.2015.05

Vinogradov BS, Gromov IM (1952) Rodents of the Fauna of USSR. Academy of Sciences of the USSR, Moscow–Leningrad. [In Russian]

Yiğit N, Çolak E, Sözen M, Özkurt Ş (1998) The taxonomy and karyology of Rattus norvegicus and Rattus rattus in Turkey. Turkish Journal of Zoology 22: 203–212.

Zaitsev MV, Voyta LL, Sheftel BI (2014) [The mammals of Russia and adjacent territories. Lipotiphlans]. Nauka, St.Petersburg. 390 pp. [In Russian]

Zagorodniuk IV (2002) Taxonomic revision and diagnostics of the rodent genus Mus from Eastern Europe. News of Biosphere Reserve "Askania Nova" 4: 130–140. [In Russian]